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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/651,877	08/29/2003	Young-Nam Hwang	5649-1148	9355

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EXAMINER
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TRINH, MICHAEL MANH

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 03/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/651,877

Applicant(s)

HWANG ET AL.

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 January 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6-19 is/are allowed.
- 6) ☒ Claim(s) 1,4,5,20 and 21 is/are rejected.
- 7) ☒ Claim(s) 4,5,22 and 23 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date October 06, 2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

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## DETAILED ACTION

\*\*\* This office action is in response to Applicant's election and amendment filed on January 28, 2005. Claims 24-36 were canceled. Claims 1-19 are current pending.

### *Election/Restrictions*

1. Claims 24-36 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention. Election was implicitly made without traverse in Paper mail date January 28, 2005.

\* Claims 24-36 were also cancelled by applicant.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 1,4,5,20,21 are rejected under 35 U.S.C. 102(e) as being anticipated by Lowrey (6,764,894).

Re claims 1 and 20, Lowrey teaches a phase-changeable memory cell and method thereof comprising at least: a substrate 12; forming a bottom electrode 22,20 on the substrate 12 (Fig 1; col 2, lines 10-32); forming a phase changeable material layer pattern 28 on the bottom electrode 22,20; and forming a top electrode 30 on the phase changeable material layer pattern 28, the top electrode 30 having a tip that extends toward the bottom electrode 22,20 (Figs 2A-2I; col 2, line 33 through col 3). Re claim 4, wherein the phase changeable material layer 28 pattern is directly on the bottom electrode 22 (Fig 1; col 2, lines 24-32). Re claim 5, wherein the cell further comprises a lower interlayer insulating layer (20/32 or 14) between the bottom electrode 22 and

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the substrate 12; and a contact plug (18 or 26) extending through the lower interlayer insulating layer (20/32 or 14, respectively) and electrically connecting the substrate 12 with the bottom electrode 22 (Fig 1; col 2, lines 10-32). Re claim 21, wherein the method further comprises: forming a middle interlayer insulating layer 26/24/32 on the bottom electrode 22, wherein the middle interlayer insulating layer defines a contact hole that exposes a part of the bottom electrode 22, and wherein forming a phase changeable material layer 28 on the bottom electrode 22 comprises forming the phase change material layer 28 in the contact hole, the phase changeable material layer 28 having a dented portion protruding toward the bottom electrode 22, and wherein forming a top electrode 30 on the phase changeable material comprises forming a conductive layer 30 on the phase changeable material layer including the dented portion of the phase changeable material layer 28 (Fig 1; col 2, lines 10-32; and Figs 2C-2I, col 2, line 33 through col 3).

4. Claims 1,4,5,20,21 are rejected under 35 U.S.C. 102(e),(a) as being anticipated by Dennison (6,605,527).

Re claims 1 and 20, Lowrey teaches a phase-changeable memory cell and method thereof comprising at least: a substrate 110; forming a bottom electrode 280/275 on the substrate 110 (Figs 8,16; col 5, line 1 through col 6, lines 33); forming a phase changeable material layer pattern 340 on the bottom electrode; and forming a top electrode 350/360/370 on the phase changeable material layer pattern 340, the top electrode 350/360/370 having a tip that extends toward the bottom electrode 280/275 (Fig 16; col 9, lines 22-57). Re claim 4, wherein the phase changeable material layer 340 pattern is directly on the bottom electrode 280 (Fig 16; col 9, lines 22-57). Re claim 5, wherein the memory cell further comprises a lower interlayer insulating layer (180,130; Figs 8,15-16,1; col 4, lines 45-67; col 3, lines 45-65) between the bottom electrode 280 and the substrate 110; and a contact plug 170,230 extending through the lower interlayer insulating layer (Fig 16) and electrically connecting the substrate 110 with the bottom electrode 280 (Fig 16). Re claim 21, wherein the method further comprises: forming a middle interlayer insulating layer 300/330 on the bottom electrode 280, wherein the middle interlayer insulating layer defines a contact hole that exposes a part of the bottom electrode 280, and wherein forming a phase changeable material layer 340 on the bottom electrode 280 comprises

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forming the phase change material layer 340 in the contact hole, the phase changeable material layer 340 having a dented portion protruding toward the bottom electrode 280, and wherein forming a top electrode 350/360/370 on the phase changeable material comprises forming a conductive layer on the phase changeable material layer including the dented portion of the phase changeable material layer 340 (Figs 15-16; col 9, lines 5-57).

*Allowable Subject Matter*

5. Claims 6-19 are allowed.

6. Claims 2-3,22-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims

**\*\*** The following is a statement of reasons for the indication of allowable subject matter:

The references including Lowrey (6,764,894), Dennison (6,605,527), of record, alone or in combination, do not anticipatively disclose each and every aspect of the claimed phase-changeable memory cell and method thereof, or fairly make a prima facie obvious case of the claimed phase-changeable memory cell and method thereof, in combination with other claimed limitations as recited in base claim, the inclusion of having a phase changeable material layer pattern on the bottom electrode, wherein the bottom electrode having a planar portion and a vertical portion, and wherein the tip of the top electrode extends toward the vertical portion of the bottom electrode.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0956.

Oacs-16-7



Michael Trinh  
Primary Examiner